Space Weather Technical Forecast

Issued on Sunday, 14 August 2022 at 12:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Ongoing Active electron fluence. Chance of G1/Minor storm on day 4 (17th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with occasional C-class flares. The largest of these was a C6.7 at 13/1300 UTC from AR3079 in the southwest quadrant and a C4.5 at 13/2307 UTC from AR3081 in the northeast. Both these regions have shown growth over the past 24 hours, with AR3081 (Dai Beta-Delta) becoming the largest and most complex region on the disc, developing a delta spot in its leading group, and AR3079 has grown to become classified a Beta/Dsi region. Another region of note is AR3076 (Cai/Beta) in the northwest, which appears to have a reverse polarity. There are five other regions on the disc which are relatively small and simple. However, AR3078 (Cso/Beta) in the southeast was the source region for a small CME around 13/1700 UTC. This has been analysed and is forecast to primarily pass to the south of Earth on the 17th. No other Earth-directed CMEs were observed in the available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, is showing a waning fast wind environment, with speeds declining from around 530km/s to 480km/s during this period and density declining to around average (6-10nT). The IMF was weak throughout with the north-south component varying weakly (+/- 5nT). The phi angle was mostly positive (away from the Sun), but with some negative variations. Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES16, was at Background levels. The high energy electron flux (greater than 2 MeV) was High for much of the period, with a peak of 6.24e3 pfu at 13/1450 UTC, but dropped to Moderate 14/0120-0900 UTC. The 24-hour integrated electron fluence was above Active throughout, with an observed value of 2.46e8 integrated pfu at 14/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to remain predominantly Low, but with a chance of increasing to Moderate.

Solar Wind / Geomagnetic Activity: Earth is currently seeing a waning high speed stream from coronal holes 10 and 12. The next coronal hole 14 is due to connect on day 4 (17th), with speeds of 500-600km/s likely. However there is the chance that this enhancement may be further enhanced by a glancing blow from a CME which left the Sun on the 13th. Geomagnetic activity is expected to be mainly Quiet, with isolated Unsettled intervals through the next three days. On day 4 (17th), activity is expected to become Unsettled to Active, with a chance a G1/Minor Storm and slight chance of G2/Moderate Storm.

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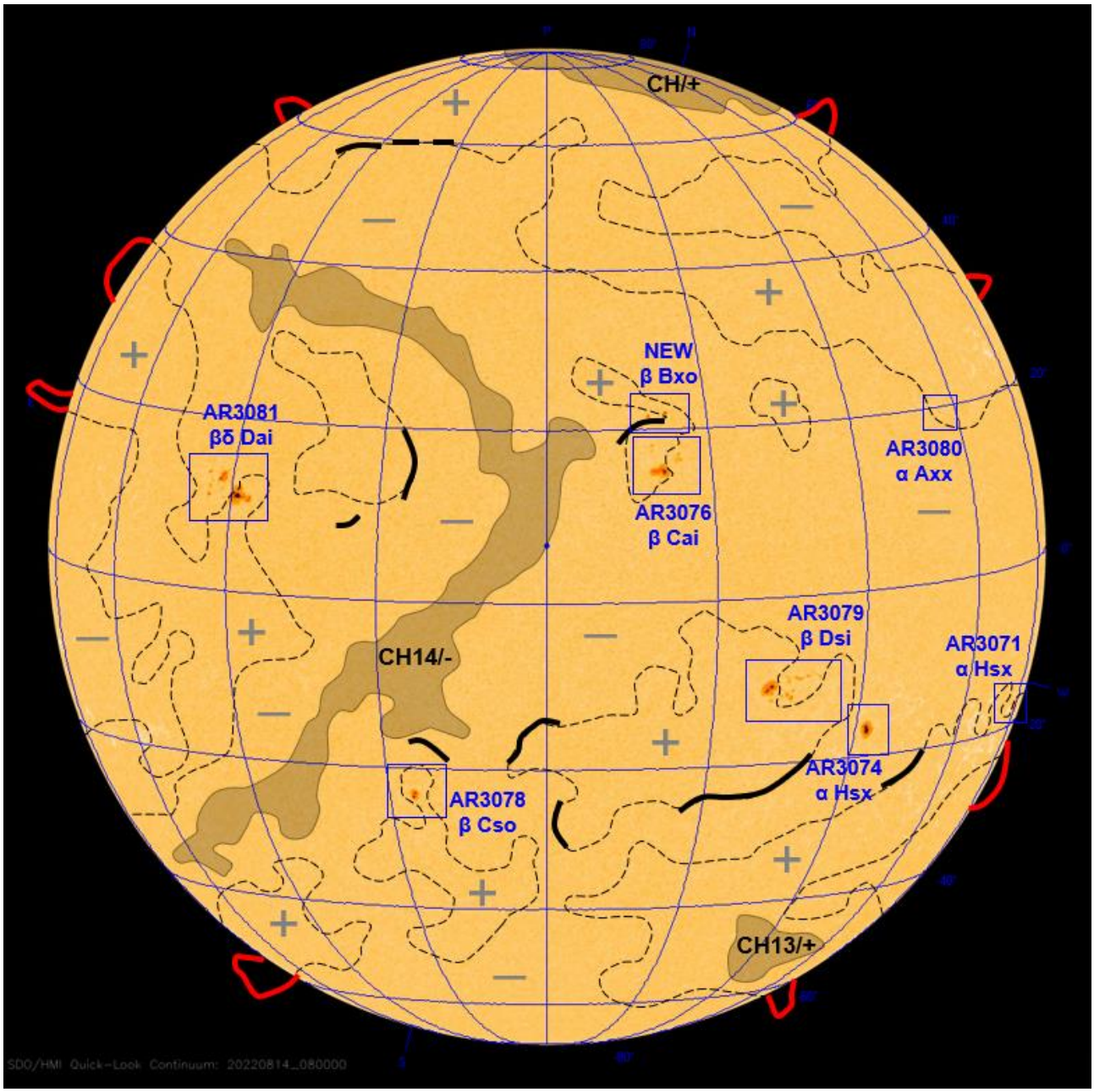
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is likely to remain at background levels, although with a slight chance of an S1 or greater event. High energy electron flux is expected to continue at a moderate to High (1e3 pfu) levels through days 1-3 (14th-16th) before becoming suppressed on day 4 (17th). Electron fluence is expected to remain above the Active threshold through much of this period.

Figure 1. Solar Analysis Valid 14/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar wind speeds are expected to continue to decline towards ambient levels over the next couple of days as CH12 and CH10 rotate from a geoeffective position. Coronal hole 14 is then due to connect with the Earth during day 4 (17th), based on a predicted high speed stream of 500-600km/s. The coronal hole is a recurrent feature and thus wind speeds are likely to be in a similar range as previous rotation, although there is a chance of further enhancement due to embedded CME effects. A CME which left the Sun on the 13th, will most likely pass to the south of Earth. However, there is a possibility of a glancing blow, and if this was to occur it would coincide with the coronal hole enhancement on the 17th.

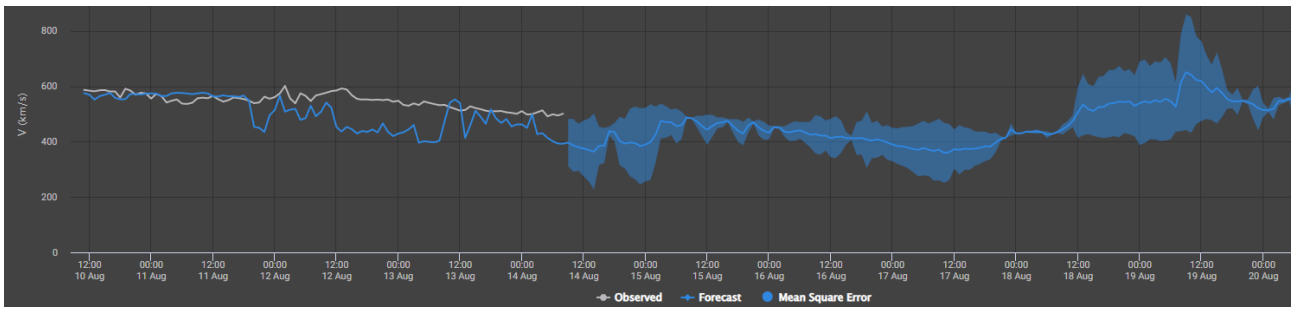
Geomagnetic activity is expected to be mainly Quiet, with isolated Unsettled intervals through the next three days. On day 4 (17th), activity is expected to become Unsettled to Active, with a chance a G1/Minor Storm. There is a slight chance of a G2/Moderate Storm if a glancing blow from the CME mentioned above occurs.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	30
Strong	G3	No	1	1	1	5
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
13/1649	Partial	Small C flare from AR3078	S40, E02	481	17/0900	Likely to miss to the south, but chance of glancing blow

Figure 2: Solar Wind Persistence Model



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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

Solar activity is currently Low, with frequent C-class flares. Activity is forecast to be mainly Low, but with a chance of Moderate flares and a very slight chance of X-class activity. AR3081 (Dai/Beta-Delta) has developed significantly in configuration and magnetic complexity over the last 24 hours and presents the most significant flare risk. AR3076 (Cai/Beta) and AR3079 (Dsi/Beta) also contribute to the flare risk, with the other regions currently on the visible disk largely benign.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and is likely to remain at this level through the period.
Both AR3076 and AR3079 have a very slight risk of proton events and are now in the western hemisphere. The increase in complexity of AR3081 is one to watch, although this is currently in the eastern disc. There is a slightly increasing risk of an S1 or greater event over the four days as this region moves towards centre disc.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	2	3	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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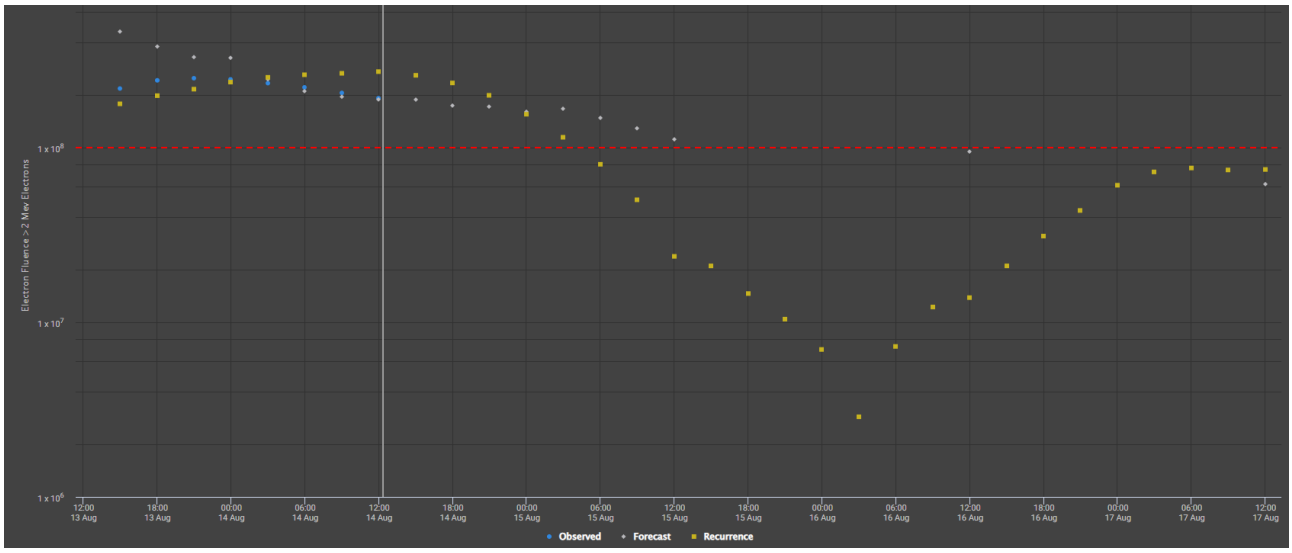
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to be at moderate to high levels throughout the next three days. On day 4 (17th), electrons are expected to become suppressed due to the expected increase in geomagnetic activity associated with the arrival of the coronal hole enhancement.
Electron fluence values are expected to remain above the Active threshold through much of this period, although confidence decreases later. REFM offering good guidance, although some uncertainty regarding the end time of the current Active spell.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	90	70	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: GOES 16 electron fluence and REFM data.



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